

City of Richfield

UTILITY TECHNICAL SPECIFICATIONS

CITY OF RICHFIELD, MINNESOTA

JANUARY 2014

PUBLIC WORKS

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SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SUMMARY

- A. Temporary utility services including, but not limited to:
 - 1. Temporary utility services and facilities.
 - 2. Construction water.
 - 3. Temporary water service.
- B. Related Sections:
 - 1. Section 33 11 00 – Water Distribution Systems
- C. Method of Measurement:
 - 1. Temporary Water System
 - a. Lump sum price for “Temporary Water Supply System” as listed on the Bid Form.
 - b. Payment shall be compensation in full for furnishing labor, equipment, and materials to provide and maintain individual, temporary water service to buildings.
 - c. Disinfection and header-pipe ramping and trenching shall be considered incidental.
- D. Basis of Payment:
 - 1. Payment for acceptable quantities of water main and appurtenances shall be at the Contract Unit Price as listed on the Bid Form. All associated work items shall be considered incidental

1.02 QUALITY ASSURANCE

- A. Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary utility services.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Provide all required materials and equipment for temporary services and facilities.
- B. Used materials and equipment may be used, if acceptable to Engineer.
- C. Provide only materials and equipment that are suitable for intended use and comply with appropriate standards.
- D. Submit product list for approval by Engineer for all temporary utility systems.

2.02 UTILITIES

- A. Where local utility company provides only a portion of temporary utility, provide remainder with matching, compatible materials and equipment. Comply with utility company’s recommendations and requirements.

2.03 SUBMITTALS

- A. Submit proposed materials and pipe sizes to be used with temporary water service system.
- B. Submit proposed staging and operations plan for temporary water service system for approval by Engineer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide each temporary service and facility ready for use at each location when service or facility is first needed.
- B. Locate temporary utilities where they will serve the Project and result in minimum interference with performance of the work.

- C. Locate temporary utilities where they will allow ADA accessibility to all adjacent properties.
- D. Maintain, relocate, modify, and extend utilities as required during course of work.
- E. Use qualified tradepersons for installation of temporary utilities.

3.02 TEMPORARY WATER SERVICE

- A. During construction, maintain potable water service to existing users on a continuous basis until service from newly installed mains can be constructed, tested, and placed into service.
- B. Provide temporary service prior to disrupting existing service.
- C. Provide minimum 48-hour written notice to Utility staff, Engineer and all affected property owners prior to service disruption.
- D. Obtain a connection approved by Owner where usage can be metered and system sanitation can be maintained.
- E. Coordinate installation with City of Richfield Utility staff.
- F. Contractor to make all connections, including flushing of existing water meters.
- G. Avoid damage to permanent plumbing at source of temporary water.
- H. Adapters, fittings, and piping materials must be pre-approved by the City Engineer.
- I. Disinfect service lines, headers, connections, and appurtenances in accordance with specifications and regulations.
- J. All piping and appurtenances shall pass disinfection tests per paragraph 3.03 prior to being put into service.

- K. Maintain temporary water distribution system to avoid damage to existing or new construction.
- L. Protect temporary water system from freezing.

3.03 CONSTRUCTION WATER

- A. Owner will pay for water used for temporary water service purposes.
- B. Secure water necessary for construction and testing and pay service connection charges.
- C. Install potable water service and distribution piping of sizes and pressures adequate for property uses.
- D. Install water service and distribution piping of sizes and pressures adequate for construction purposes.
- E. Where available supply of potable water is inadequate, provide non-potable water for purposes other than drinking and washing.
- F. Where non-potable water is used, provide warning signs on the discharge end of each length of hose and at the shut-off nozzles.
- G. Where shut-off nozzles are used at water hose discharge, provide heavy-duty abrasion-resistant hoses with a pressure rating at least twice the maximum pressure of the water distribution system.
- H. Trades needing a larger source of water are responsible for the source and distribution.
- I. Exercise control over usage to conserve water.
- J. Sterilize temporary water piping for potable water prior to use.
 - 1. Disinfect all newly installed water mains, appurtenances and services in accordance with AWWA C651.
 - a. Granular or Continuous Feed Method:

- 1) Hold chlorine solution in pipe for a minimum period of 24 hours.
 - a) Initial dosage: 50 ppm minimum.
 - b) Residual dosage after hold period: 10 ppm minimum.
2. Flush system 24 - 48 hours after initial dosage of chlorine.
3. Sampling and Testing:
 - a. After final flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
 - b. Each sample set shall include:
 - 1) One sample for every 1,200 feet of main.
 - 2) One sample at each dead-end.
 - 3) Ensure that 1 sample is obtained from each branch of main.
 - 4) Minimum sample required: 2
 - c. Perform coliform tests on each sample.
 - d. Rechlorinate if any sample tests positive for coliform.
 - e. Provide accepted coliform testing results to Engineer prior to connection of temporary water system to existing properties or services.
- K. Maintain distribution system to avoid damage to existing or new construction.
- L. Avoid damage to permanent plumbing at source of temporary water.

3.04 OPERATION, TERMINATION, AND REMOVAL

- A. Enforce strict discipline in use of temporary services and facilities at the site.
 1. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse.
 2. Do not permit temporary installations to be abused or endangered.
 3. Do not allow hazardous, dangerous, or unsanitary conditions to develop or persist on site.

- B. Operate temporary services and facilities in a safe and efficient manner.
 1. Do not overload temporary services or facilities.
 2. Protect from damage by freezing temperatures and similar elements.
 3. Prevent water-filled piping from freezing by use of ground covers, insulation, draining, or by temporary heating.
 4. Maintain distinct markers for underground lines.
 5. Protect from damage during excavation operations.
- C. Unless Engineer requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when no longer needed, when it has been replaced by the authorized use of a permanent facility, or no later than Substantial Completion.
- D. Complete or restore permanent work which may have been delayed because of interference with temporary service or facility.
- E. Repair damaged work, clean exposed surfaces, and replace work which cannot be satisfactorily repaired.
- F. Materials and facilities that constitute temporary services and facilities are, and will remain, the property of Contractor.
- G. At Substantial Completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during construction, including but not limited to:
 1. Replace significantly worn parts and parts that have been subject to unusual operating conditions.

END OF SECTION

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SECTION 31 23 33

TRENCH EXCAVATIONS AND BACKFILL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Trench Excavation
 - 2. Special Pipe Foundation
 - 3. Trench Backfill
 - 4. Compaction
 - 5. Pipe Grade and Alignment Conflicts
- B. Related Sections:
 - 1. Section 33 11 00 - Water Distribution Systems
 - 2. 33 31 00 – Sanitary Sewer Systems
 - 3. 33 41 00 – Storm Sewer Systems
- C. Method of Measurement
 - 1. Trench Excavation and Backfill:
 - a. Incidental to associated pipe installation.
 - 2. Special Pipe Foundation Materials:
 - a. Incidental to associated pipe installation.
 - b. Bid price includes removal and disposal of material replaced.
 - 3. Replacement Backfill:
 - a. Incidental to associated pipe installation.
 - b. Bid price includes removal and disposal of material replaced.
 - 4. Compaction: Incidental to associated pipe installation.
 - 5. Dewatering: Incidental to associated pipe installation.
- D. Basis of Payment
 - 1. Payment for quantities measured in this section shall be at the contract unit price as listed on the Bid Form. All associated work items shall be considered incidental.

1.02 SUBMITTALS

- A. Provide for each granular material:
 - 1. Name and location of source.
 - 2. Sample gradation.

1.03 SITE CONDITIONS

Groundwater: Provide trench dewatering if groundwater surface is above or within 3 feet of the pipe zone.

1.04 WARRANTY

- A. Contractor to repair all trench settlements and resulting damage or displacement of surface facilities that occurs within two years after final project approval.

PART 2 PRODUCTS

2.01 SOIL MATERIALS, GENERAL

- A. Soil for fill and backfill shall be free of organic matter, debris, frozen soils, ice, and other objectionable materials. Rock particles larger than maximum size specified shall be removed.
- B. Select existing material excavated from site may be used if it meets requirements specified. If necessary, furnish additional approved material from suitable off-site sources.

2.02 GRANULAR BASE, BEDDING, AND BACKFILL

- A. Use select soils complying with ASTM D2487 soil classification groups GW (well-graded gravel), GP (poorly graded gravel), SW (well-graded sand), SP (poorly graded sand), or combinations thereof. Aggregate shall pass a 3/4-inch sieve and not more than 35 percent

shall be retained on a No. 10 sieve.
Maximum 3 percent by weight may pass a
No. 200 sieve.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Trench Excavation

1. Trench Safety
 - a. All excavations shall conform to OSHA Standards for Excavating, Trenching and Shoring.
2. Alignment and Grade
 - a. Excavate trench to alignment and grade as staked.
 - b. Excavate no more than 100 feet in advance of pipe laying operation.
3. Trench Width at Pipe Zone
 - a. Center trench on pipe alignment.
 - b. Minimum Width: Pipe O.D. + 12 inches.
 - c. Maximum Width: Pipe O.D. + 24 inches (except rock excavation).
4. Excavated Materials
 - a. Use stable material for backfill.
 - b. Waste unstable material as directed.
 - c. Do not place materials on sidewalk, driveways or drainageways.
5. Drainage
 - a. Provide dewatering trenches when required.
 - b. Meet NPDES Requirements for dewatering.
 - c. Do not drain trench water into sanitary sewer.

B. Pipe Foundations

1. Engineer to determine stability of the trench bottom.
2. Stable trench bottom.
 - a. Shape trench bottom to conform to bottom half of pipe.
 - b. Excavate bell holes to permit proper jointing.

C. Trench Backfill

1. Pipe Zone
 - a. Use native material free of rocks and other unsuitable debris.

- b. Deposit material uniformly on both sides of pipe throughout entire trench width.
 - c. Place material in 6-inch lifts and mechanically compact.
2. Above Pipe Zone
 - a. Use native materials free of debris and rock, concrete or clay lumps with a volume greater than 1/3 cubic foot.
 - b. Place in uniform lifts no more than 1-foot thick.
 - c. Mechanically compact each lift of the upper 3 feet of the trench to a Standard Proctor Density of 100 percent.
 - d. Mechanically compact each lift under the upper 3 feet of the trench to a Standard Proctor Density of 95 percent.
 - e. Do not backfill unless approved compaction equipment is operating.
 - f. Fine grade street subgrade to staked elevation and cross section.
3. Excess or Deficiency of Backfill Material
 - a. Dispose of excess backfill material as directed after all trenches are backfilled.

3.02 FIELD QUALITY CONTROL

- A. Density tests on backfill materials will be as directed by the Engineer.
- B. Contractor to recompact all areas represented by failed density tests.
- C. Owner will provide for initial test and first retest.
- D. Costs of subsequent retests to be deducted from Contractor's payment.

3.03 PIPE CLEARANCES AND CONFLICTS

- A. Provide clearance between sewers and watermain as follows:
 1. Maintain 10-foot horizontal between pipes.

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2. Maintain 18-inch vertical separation between pipes.
- B. When 18-inch vertical separation between sewer and watermain cannot be maintained, provide special pipe crossing as follows:
1. Advise Engineer of pipe conflict.
 2. Lower watermain in accordance with plan detail or as directed.
 3. Provide 18-inch vertical separation between pipes.
 4. Construct sewer using pipe material and joints equal to watermain at the crossing point.
 5. Center pipe lengths at the crossing point.
 6. Provide special foundation material for both pipes.
 7. Place insulation as directed.

END OF SECTION

SECTION 33 05 50

SURFACE FACILITY RESTORATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes restoration of surface facilities after utility construction as follows:
 - 1. Street Surfaces
 - 2. Base Course
 - 3. Curb and Gutter
 - 4. Sidewalks
 - 5. Driveways
 - 6. Shoulders
- B. Related Sections:
 - 1. Section 31 23 33 - Trench Excavation and Backfill
- C. Method of Measurement
 - 1. Aggregate Base
 - a. Measure by volume in tons.
 - b. Multiply individual areas in square yards by specified depth in inches.
 - 2. Bituminous Surface
 - a. Measure by square yards.
 - b. Multiply individual areas in square yards by specified depth in inches.
 - c. Bid price includes bituminous material.
 - 3. Concrete Surface
 - a. Measure by area in square yards for each uniform depth.
 - 4. Curb and Gutter
 - a. Measure by length in linear feet.
- D. Basis of Payment
 - 1. Payment for acceptable quantities of Surface Facility Restoration items shall be at the contract unit price as listed on the Bid Form. All associated work items shall be considered incidental.

1.02 REFERENCES

- A. Mn/DOT:
 - 1. 2360 - Plant-Mixed Bituminous Surface

- 2. 2357 - Bituminous Tack Coat
- 3. 2461 - Structural Concrete
- 4. 2521 - Walks
- 5. 3138 - Aggregate for Surface and Base Courses
- 6. 2531- Concrete Curbing

1.03 SUBMITTALS

- A. Provide for each aggregate material:
 - 1. Name and location of source.
 - 2. Sample gradation.
- B. Provide for bituminous mixture:
 - 1. Mix design report.

1.04 SCHEDULING

- A. Restore all surface facilities within 72 hours after removal.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate Base Materials: In accordance with Mn/DOT 3138, Class 5.
- B. Bituminous Patching Mixtures: In accordance with Mn/DOT 2360.2.
- C. Bituminous Tack Coat: In accordance with Mn/DOT 2357.2A.
- D. Concrete: In accordance with Mn/DOT 2461, 2521 and 2531. Mix as specified in Contract Documents and Bid Form.

PART 3 EXECUTION

3.01 PREPARATION

- A. Bituminous Surface

1. Sawcut existing bituminous to provide a clean straight edge.
2. Place tack coat on all edges.

B. Concrete

1. Provide a clean straight edge on abutting concrete by breakage at an existing joint or by sawcutting.
2. Install ½-inch preformed expansion joint against all abutting concrete.

3.02 CONSTRUCTION REQUIREMENTS

A. Aggregate Base

1. Place material to a uniform depth as specified.
2. Mechanically compact to a Standard Proctor Density of 100 percent.

B. Bituminous Surfaces

1. Place adequate material to provide proper depth when compacted.
2. Compact until all roller marks are eliminated and there is no further evidence of consolidation.
3. Surface shall be flush with adjacent surfaces and within 1/8-inch of a 10-foot straight edge in all directions.
4. Surface shall be smooth and free of open sections.

C. Concrete Curb and Gutter

1. Install forms to provide designated cross section.
2. Place and compact concrete in a manner to avoid segregation.
3. Provide a light brush finish on all exposed surfaces.

D. Concrete Surfaces

1. Place and compact concrete in accordance with Mn/DOT 2521.3C.
2. Surface shall be flush with adjacent surfaces.
3. Provide a light brush finish on all exposed surfaces.

END OF SECTION

SECTION 33 11 00

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Water main pipe and fittings.
 - 2. Valves and boxes.
 - 3. Hydrants.
 - 4. Services.
 - 5. Insulation.
 - B. Related Sections:
 - 1. Section 31 23 33 - Trench Excavation and Backfill
 - 2. Section 33 05 50 - Surface Facility Restoration
 - C. Method of Measurement:
 - 1. Water Main:
 - a. Measure by distance in linear feet.
 - b. Measure along pipe axis with no deduction for fittings or valves.
 - c. Water Main includes bedding per Standard Detail Drawings.
 - d. Water Main includes polyethylene encasement.
 - e. Measure in the horizontal plane unless pipe grade exceeds 15 percent.
 - 2. Fittings:
 - a. Measure by weight in pounds.
 - b. Basis of Weight:
 - 1) Meet AWWA C 110 or C153.
 - 2) Exclude weights of glands, gaskets, rods, bolts, and other accessories.
 - 3. Valves and Boxes: Measure valve and box of each size and type as a unit.
 - 4. Hydrants:
 - a. Measure hydrants of each size and type as a unit.
 - b. Unit includes installation of hydrant, base, blocking, and crushed rock.
 - 5. Hydrant Extension: Measure by length in linear feet.
 - 6. Corporation Stops: Measure corporation stops of each size and type as a unit.
 - D. Basis of Payment:
 - 1. Payment for acceptable quantities of water main and appurtenances shall be at the Contract Unit Price as listed on the Bid Form. All associated work items shall be considered incidental.
- 7. Curb Stops and Boxes: Measure curb stops and boxes of each size and type as a unit.
 - 8. Service Pipe:
 - a. Measure by distance in linear feet.
 - b. Measure each size separately.
 - c. Measure from center of water main to center of curb stop plus 1-foot for slack.
 - 9. Insulation: Measure by volume in board feet.
 - 10. Relocation of Inplace Facilities: Measure as indicated in Contract Documents and Bid Form.
 - 11. Access Structures: Measure as indicated in Contract Documents and Bid Form.

1.02 REFERENCES

- A. ASTM:
 - 1. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 2. A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - 3. A536 - Ductile Iron Castings
 - 4. A563 - Carbon and Alloy Steel Nuts
 - 5. B88 - Seamless Copper Water Tube
 - 6. B152 - Copper Sheet, Strip, Plate, Rolled Bar
 - 7. D429 - Tests for Rubber Adhesion to Rigid Surfaces
 - 8. D2842 - Tests for Water Absorption of Rigid Cellular Materials
 - 9. D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable
 - 10. F593 - Stainless Steel Bolts, Hex Cap Screws, and Studs
 - 11. F594 - Stainless Steel Nuts

B. AWWA:

1. C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. C105 - Polyethylene Encasement for Ductile -Iron Pipe Systems
3. C110 - Ductile-Iron and Gray-Iron Fittings
4. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C150 - Thickness Design of Ductile Iron Pipe
6. C151 - Ductile-Iron Pipe, Centrifugally Cast for Water or other Liquids
7. C153 - Ductile-Iron Compact Fittings for Water Service
8. C502 - Dry-Barrel Fire Hydrants
9. C504 - Rubber-Seated Butterfly Valves
10. C509 - Resilient-Seated Gate Valves for Water Supply Service
11. C515 - Reduced-Wall, Resilient-Seated Gate Valves, for Water Supply Service
12. C600 - Installation of Ductile Iron Water Mains and their Appurtenances
13. C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
14. C651 – Disinfecting Water Mains
15. C800 – Underground Service Line Valves and Fittings
16. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for Water Distribution
17. C901 – Polyethylene (PE) Pressure Pipe and Tubing, ½ in. Through 3 in., for Water Service
18. C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. Through 48 in., (350 mm Through 1,200 mm), for Water Transmission and Distribution
19. C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 63 in., for Water Distribution
20. C907 – Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 in. Through 8 in. (100 mm Through 200 mm)

C. City of Richfield Municipal Code

1. Chapter 800 – work in the Right-of-Way

1.03 SUBMITTALS

- A. Submit Certificate of Compliance for products listed under Article 1.04.

- B. Submit a list of materials and suppliers for approval.
- C. Submit proposed method of joint conductivity.

1.04 QUALITY ASSURANCE

- A. Provide Certificates of Compliance from the manufacturer certifying that the following products meet the respective requirements listed in Article 1.02:
1. Water Main
 2. Fittings
 3. Valves & Boxes
 4. Hydrants
 5. Service Fittings
 6. Service Pipe
 7. Insulation

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspection:
1. Inspect all pipe and products during the unloading process.
 2. Notify Engineer of any cracked, flawed or otherwise defective products.
 3. Remove all products found to be defective by the Engineer from the site.
- B. Handling and Storage: Handling and storage of products shall be in accordance with Section 2.2 of AWWA C600.

PART 2 PRODUCTS

2.01 WATER MAIN PIPE

- A. Ductile Iron: AWWA C151.
- B. Cement-Mortar Lining: AWWA C104.
- C. Thickness Class: 52, or as specified in Contract Documents.
- D. Joints: Push-On.
- E. Joint Conductivity:
1. Conductive gaskets as manufactured by American Ductile Iron Pipe Co.

2. Field Application Methods:
 - a. Burndy - Thermoweld by Burndy Corp., Norwalk, Connecticut.
 - b. Cadweld by Erico Products Co., Cleveland, Ohio.
3. Copper Jumpers:
 - a. Minimum 1/16-inch by 1/2-inch wide flat copper strip.
 - b. Annealed round copper wire conforming to ASTM B152, Type DHP.
4. Nuts and Bolts: Silicon Bronze.

2.02 FITTINGS

- A. Ductile Iron:
 1. 4 inch through and including 12 inch
 - a. AWWA C153
 2. Greater than 12 inch
 - a. AWWA C 110
- B. Cement-Mortar Lining: AWWA C104.
- C. Joints: Mechanical.
- D. Restrained Joint Retainer Glands:
 1. American, US Pipe, or Mega-Lug type.
 2. Ductile Iron
- E. Nuts and Bolts: Cor-Blue or approved equal.
- F. Threaded Metal Tie Rods: Stainless Steel rods and nuts. Treated after installation with asphaltic rustproofing.

2.03 VALVES AND BOXES

- A. Gate Valves:
 1. Resilient Seated: AWWA C515.
 2. Working Pressure: 200 psi.
 3. Ends: Mechanical Joint.
 4. Operating Stem: Non-Rising with O-ring Seals.
 5. Operating Nut: 2-inch Square, Open Left.
 6. Markings to be cast on the bonnet or body:
 - a. Open indicating arrow.
 - b. Manufacturer's name.
 - c. Pressure rating.
 - d. Year of manufacture.
 - e. Size.

- B. Butterfly Valves:
 1. Rubber Seated: AWWA C504.
 2. Class: 150B.
 3. Body Type: Mechanical - Joint-End.
 4. Disc:
 - a. 316 stainless steel edge
 - b. 3-inch thru 24-inch: ASTM A126 Class B Cast Iron
 - c. 30-inch and larger: ASTM A536 Ductile Iron
 5. Seat:
 - a. 3-inch through 20-inch: Bond to body per ASTM D429, Method B.
 - b. 24-inch and larger: Retain in body without use of metal retainers.
 6. Operator:
 - a. Traveling nut actuator
 - b. Open left.
 7. Markings to be cast on the body:
 - a. Open indicating arrow.
 - b. Manufacturer's name.
 - c. Class.
 - d. Year of manufacture.
 - e. Size.
- C. Boxes:
 1. Tyler Series 6860 with cover labeled "Water", or approved equal
 2. Cast Iron, 5-1/4-inch shaft.
 3. Vertical, 3 piece, Buffalo type.
 4. Box length to provide for 8 feet of pipe cover.
 5. Adjustable to 6 inches up or down from standard box length.

2.04 HYDRANTS

- A. Dry Barrel: AWWA C502.
- B. Waterous Pacer WB67-250 or equal.
- C. Hose Connections: 2 each at 2-1/2-inch diameter.
- D. Pumper Connection: 1 each at 4-inch diameter, Storz.
- E. Threads: National Standard.
- F. Operating Stem: Open Left with O-ring Seals.
- G. Traffic flange.

- H. Hub: 6-inch Mechanical Joint.
- I. Bolts and Nuts: ASTM F593 and F594 type 304 Stainless Steel
- J. Main Valve Opening: 5 -inch diameter.
- K. Valve: Faced with specially processed valve rubber with tapered seat for positive closure. Entire mechanism shall be removed for repairs or replacement through the barrel without excavating.
- L. Barrel Diameter: 5-inch.
- M. Outlet Nipples: Bronze, securely fastened into nozzle section. Hose and steamer caps shall be provided with rubber gaskets.
- N. Drain to operate only when hydrant is closed. Omit or plug drain only if specified in Contract Documents.
- O. In areas where hydrant base is installed below the ground water, the drain holes shall be plugged and the hydrant marked with a metal tag to indicate the requirement to pump the hydrant after use.
- P. Bury Depth: 8 feet-6 inches (ground to bottom of hub) unless otherwise specified in Contract Documents.
- Q. Minimum Nozzle Height (from flange): 22 inches.
- R. Cap Nuts: Pentagon.
- S. Color: Factory Red.
- T. Provide permanent markings which indicate:
 - 1. Manufacturer's name.
 - 2. Year of manufacture.
 - 3. Bury depth.
- U. Provide the following upon request by Engineer:
 - 1. Detailed drawings
 - 2. Catalog information
 - 3. Maintenance Data
- V. Accessories:
 - 1. Hydra-Finders (red and white).

2.05 TAPPING SLEEVE:

- 1. Ford – Fast Tap, JCM Model 432 Stainless Steel Tapping Sleeve, or approved equal.
- 2. Stainless steel.
- 3. Mechanical joint outlet for connection to tapping valve.

2.06 SERVICE PIPE

- A. Copper: ASTM B88.
- B. Type: K, Soft.

2.07 BRASS FITTINGS

- A. All fittings shall conform to ANSI/AWWA Standard C800, latest version.
- B. All brass components in contact with potable water must be made from either CDA/UNS Brass Alloys C89520 or C89833 with a maximum lead content of 0.25% by weight. Brass alloys not listed in ANSI/AWWA C800 Paragraph 4.1.2 are not approved. Brass Saddles shall be made from CDA/UNS C83600.
- C. All service fittings shall be certified as suitable for contact with drinking water by an ANSI accredited organization in accordance with ANSI/NSF Standard 61, Drinking Water Systems Components – Health Effects.
- D. All fittings shall be stamped or embossed with a mark or name indicating that the product is manufactured from the low-lead alloy as specified in paragraph 4.

2.08 CORPORATION STOPS

- A. Type: A.Y. McDonald 4701B, or equal.
 - 1. Inlet: AWWA taper thread.
 - 2. Outlet: Copper flare straight connection.

2.09 CURB STOPS AND BOXES

- A. Valve:
 - 1. Type: A.Y. McDonald 6104B, or equal.
 - a. Inlet: flared Copper Service Thread.
 - b. Outlet: flared Copper Service Thread.

- B. Box:
 1. A.Y. McDonald 5627, or approved equal.
 2. Type: Minneapolis Pattern, Extension.
 3. Length: 8 feet.
 4. Adjustable to 6 inches up or down from specified length.
 5. **No** stationary rods.

- C. Casting:
 1. McDonald Type A – 674MA Series (4” bury depth) recessed cover frame.
 2. Install at all locations where curb stop box is in driveway, sidewalk, or parking areas.

2.10 INSULATION

- A. Rigid, extruded polystyrene board insulation.
- B. Thermal Resistance (R): 5.0.
- C. Thickness: 2-inch.
- D. Board Size: 48-inch by 96-inch.
- E. Compressive Strength: Minimum 25 psi.
- F. Water Absorption in accordance with ASTM D2842: 0.1 percent by volume, maximum.
- G. Edges: Square.

2.11 ENCASEMENT

- A. Polyethylene Sheet: AWWA C105 Low Density
- B. Thickness: 8 mil

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. Connection to Existing System: Provide **48 hours** notice to Engineer and City Utilities Division prior to disturbing any water service. Contractor shall deliver **written 48 hour advance notice** to any residents who will be affected by the shutting off of water.
 1. Pressure Tap:
 - a. Install tap in location shown on the Drawings.
 - b. Expose water main sufficiently to facilitate the connection.
 - c. Use approved tapping machine designed specifically for tapping under pressure.
 - d. Install tapping sleeve and gate valve as part of assembly.
 - e. Install blocking as required.
 2. Cut-In Connection:
 - a. Isolate segment of pipe to be cut and drain water from the line.
 - b. Take every precaution necessary to prevent dirt or debris from entering existing lines.
 - c. Connect tee and sleeve assembly to pipe ends.
 - d. Install blocking as required.
 3. Connect to Inplace Fitting:
 - a. Isolate segment of inplace pipe and remove blocking as required.
 - b. Take every precaution necessary to prevent dirt or debris from entering existing lines.
 - c. Remove plug and drain water from the line.
 - d. Install blocking as required.
- B. Work shall not commence before 7:00 a.m. nor extend beyond 10:00 p.m. Monday thru Friday. On Saturdays, work hours are from 8:00 a.m. to 6:00 p.m. No work is permitted on Sundays or Holidays unless authorized by the City of Richfield. The definition of “work” also includes the starting of equipment and the delivery of materials to the job site.
- C. Pipe Installation:
 1. Install pipe at the alignment and grade shown on the Drawings.

2. Provide a minimum of 7.5 feet of cover over the pipe.
3. Install appurtenances in the locations shown on the Drawings.
4. Remove all dirt and foreign material from the pipe interior prior to installation.
5. See Section 31 23 33 for pipe foundation and backfill procedures.
6. See Section 31 23 33 in case of conflicts with existing pipes.
7. Install watertight plugs in all open ends of the pipe line when pipe laying is not in progress, including noon hour and overnight periods.

D. Valve and Box Installation:

1. Verify that subgrade material is adequate to support valve assembly.
2. Install valves with stems vertical and plumb.
3. Install boxes plumb and centered over the valve nut.
4. Verify that box remains plumb and centered during backfill.
5. Adjust box cover to required grade.

E. Hydrant Installation:

1. Verify that subgrade material is adequate to support hydrant.
2. Place thrust block, crushed rock and plastic sheeting in accordance with Drawing details.
3. Install and maintain hydrant in a plumb position.
4. Where groundwater is present, plug drain hole and affix "Pump After Use" tag to the hydrant.

F. Joint Conductivity:

1. Provide electrical bond across all joints between pipes and appurtenances.
2. Install copper jumpers by either shop or field applications.
3. Fasten multiple jumper strips with silicon bronze bolts and nuts.
4. Welding:
 - a. Grind surfaces to be welded to remove coating and oxide and to provide clean metal surface.
 - b. Use metallic-arc process for shop applications.
 - c. Use exothermic process for field applications.

- d. Refinish welded area with protective coating after connection is made.

G. Thrust Restraint:

1. Install thrust restraints at all bends, tees and plugs.
2. Concrete Blocking:
 - a. Place between the fitting and undisturbed trench wall.
 - b. Minimum thickness: 12 inches.
 - c. Minimum area in square feet shall be in accordance with the following:

Pipe	Tee or Plug	1/4 Bend	1/32 and 1/8 Bend	1/16 Bend
6-inch	2.9	3.1	1.6	0.8
8-inch	3.7	5.3	2.9	1.4
10-inch	5.7	8.1	4.4	2.2
12-inch	8.1	13.4	6.6	3.2
16-inch	15.1	21.4	11.6	5.9
20-inch	23.2	30.2	18.1	9.3
24-inch	33.6	48.5	26.1	13.3

- d. Size blocking based on the larger main.
 - e. Verify that bolts are accessible after concrete is poured.
 3. Timber Blocking:
 - a. Shall not be used.
 4. Restrained Joints:
 - a. Submit method and type to Engineer for approval.
 - b. Install in accordance with "Thrust Restraint Design for Ductile Iron Pipe".
- H. Service Installation:** Contractor shall keep accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings. Complete records shall be submitted by the Contractor to the Engineer upon completion of the work.
1. Corporation Stops:
 - a. Provide watertight connection with approved tapping machine.
 - b. Install under main pressure.
 - c. Place a double wrap of Teflon tape around the threads prior to installation.
 2. Copper Service Pipe:
 - a. Install pipe between corporation stop and curb stop with no joints or unions.

- b. Flare copper tubing ends with proper size and type of tools as designated for the purpose.
 - c. Bury Depth: 8 feet.
 - d. Provide minimum 1-foot of slack in the pipe to allow for settlement and movement.
 - e. Install service pipe at right angles to water main or property line, a minimum of 4 feet from sanitary sewer services, and 10 feet away from all other sewer services.
3. Curb Stop and Box:
- a. Install at the location shown on the Drawings.
 - b. Install one-foot length of copper service line on the outlet side of the curb stop. Stub end shall be pinched closed to prevent partial intrusion.
 - c. Verify that subgrade material is adequate to support the curb box assembly.
 - d. Install boxes plumb and centered over the tee head.
 - e. Verify that box remains plumb and properly aligned during backfill.
 - f. Adjust box cover to required grade.
 - g. Key all curb stops after backfill to ensure proper operation.
 - h. Mark curb stops and service ends as specified in Contract Documents.

I. Encasement:

- 1. Comply with AWWA C105.
- 2. Wrap all pipe and fittings in the location shown on the Drawings.
- 3. Clean all surfaces of pipe and appurtenances prior to wrapping.
- 4. Provide sufficient slack to prevent damage during backfill.
- 5. Provide minimum 6-inch overlap at joints.
- 6. Secure overlap and joints with compatible adhesive tape.
- 7. Repair damaged wrap with tape or polyethylene patch.

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests upon completion of the system, after all blocking has reached design strength and prior to being placed into service:

1. Pressure and Leakage Test:

- a. Perform pressure and leakage test in accordance with AWWA C600.
- b. Test Pressure: 150 psi.
- c. Test Duration: 2 hours.
- d. Gage Requirements:
 - 1) Size: 4-1/2-inch dial.
 - 2) Range: 0 to 200 psi.
 - 3) Gradation: 2 psi.
 - 4) Accuracy: 1/2 percent.
- e. Do not allow pressure to vary more than 5 psi during the test.
- f. Do not allow pressure to vary more than 2 psi during the last hour of the test.
- g. Allowable Leakage: One-half of the volume allowed by AWWA C600 in accordance with the following:

$$L = \frac{SD}{266,400} P$$

L = Allowable Leakage in Gallons Per Hour

S = Length of Pipe Tested in Feet

D = Nominal Diameter of Pipe in Inches

P = Average Test Pressure During Test in Pounds/ Square Inch (Gage)

2. Testing Services:

- a. Perform separate pressure and leakage test on the services with the corporation stops open.
- b. Test Pressure: 100 psi.
- c. Allowable Leakage: None.
- d. At Contractor's option, service testing may be done concurrent with main testing.

3. Electrical Conductivity Test:

- a. Perform electrical conductivity test to verify that electrical thawing of the system may be accomplished by Owner.

- b. Test Parameters:
 - 1) Perform test within 1 week after pressure testing.
 - 2) Perform test after back-filling is completed and while line is at normal operating pressure.
 - 3) Test Current: 350 amperes DC plus or minus 10 percent.
 - 4) Test Duration: 5 minutes.
 - 5) Test between hydrants in segments of convenient length.
- c. Procedures:
 - 1) Furnish DC current source, cable and all required equipment of adequate capacity to accomplish the test.
 - 2) Clamp cables to hydrant flange bolts.
 - 3) Conduct test with hydrant in the open position and caps on.
 - 4) Measure current continuously throughout the test with a DC ammeter hooked on a cable lead.
 - 5) Start test at minimum current level and increase to test level.
 - 6) Drain hydrant and tighten caps after test.
- d. Failure and Correction:
 - 1) Failure of a segment shall be determined by current measurements that are insufficient, intermittent or unsteady.
 - 2) Isolate and correct defective contact points as indicated by failed tests.
 - 3) Retest failed segments after correction.
- 4. Operational Inspection:
 - a. Upon completion of the project and in the presence of the Engineer and the Contractor, representatives of the City of Richfield shall:
 - 1) Operate all valves, hydrants, and water services to ascertain that the entire facility is in good working order.
 - 2) Ensure that all valve boxes are centered and valves are opened.
 - 3) Ensure that all hydrants operate and drain properly.
 - 4) Ensure that all curb boxes are plumb and centered.
 - 5) Ensure that water is available at all curb stops.

3.03 DISINFECTION

- A. Disinfect all newly installed water mains, appurtenances and services in accordance with AWWA C651.
 - 1. Tablet or Continuous Feed Method:
 - a. Hold chlorine solution in pipe for a minimum period of 24 hours.
 - 1) Initial dosage: 50 ppm minimum.
 - 2) Residual dosage after hold period: 10 ppm minimum.
- B. Flush system within 24 hours after disinfection is completed.
- C. Sampling and Testing:
 - 1. After final flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
 - 2. Each sample set shall include:
 - a. One sample for every 1,200 feet of main.
 - b. One sample at each dead-end.
 - c. Ensure that 1 sample is obtained from each branch of main.
 - d. Minimum sample required: 2
 - 3. Perform coliform tests on each sample.
 - 4. Rechlorinate if any sample tests positive for coliform.

END OF SECTION

SECTION 33 31 00

SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Gravity sanitary sewer pipe.
2. Sanitary manholes and appurtenances.
3. Service connections.
4. Service pipe.
5. Riser pipe.

B. Related Sections:

1. Section 31 23 33 - Trench Excavation and Backfill
2. Section 33 05 50 - Surface Facility Restoration

C. Method of Measurement:

1. Sewer Pipe:

- a. Measure by distance in linear feet.
- b. Measure along longitudinal axis from manhole centers with no deduction for fittings.
- c. Measure each pipe size, class, and depth zone separately.

2. Manholes:

- a. Measure each size and type individually as a unit.
- b. Unit includes granular foundation, base, precast barrel and cone sections, rings, frame, and cover to a depth of 8 feet.
- c. Measure depth from lowest invert to top of frame.

3. Extra Manhole Depth:

- a. Measure by distance in linear feet.
- b. Measure total distance from lowest invert to top of frame less 8 feet.

4. Manhole Drop Section:

- a. Measure by each.
- b. Measure from upper to lower pipe invert.
- c. Unit includes base extension, fittings, drop pipe, collar, granular encasement, holes into manhole for drop section, and differential cost of

special lateral pipe material to a depth of 2 feet.

5. Extra Depth Drop Connection:

- a. Measure by distance in linear feet.
- b. Measure total distance from lowest invert to high pipe inlet of drop section less 2 feet.

6. Manhole Connections:

- a. Measure connections to an existing manhole as a unit.
- b. Unit includes cutting and patching of manhole wall and base, and construction of a new invert.

7. Special Fittings

- a. Measure each size and type individually as a unit.
- b. Excludes any such fitting required to be installed as a component part of any other work unit.
- c. Unit includes all materials and appurtenances necessary to install fitting as specified or directed by Engineer.

8. Service Connections: Measure fittings of each size and type as a unit.

9. Service Pipe:

- a. Measure by distance in linear feet of each size.
- b. Measure horizontally from end of riser fitting to end of pipe.

10. Riser Pipe:

- a. Measure by distance in linear feet for each size.
- b. Measure vertically from end of service wye connection fitting to end of riser fitting.

11. Trace Wire

- a. No measurement will be made for trace wire and shall be considered incidental.

12. Calcium Chloride Solution

- a. Measure by volume in gallons.
- b. Measure mixed gallons of solution applied.
- c. Measurement includes furnishing, mixing, and applying the material as specified or directed by Engineer.

D. Basis of Payment:

1. Payment for acceptable quantities of sanitary sewer items shall be at the Contract Unit Price as listed on the Bid Form.
2. All associated Work items shall be considered incidental.
3. Maintaining sanitary sewer service during construction shall be considered incidental.

1.02 REFERENCES

A. ANSI:

1. A21.4 - Standard for Cement - Mortar Lining for Ductile Iron Pipe and Fittings
2. A21.11 - Standard for Rubber - Gasket Joints for Ductile Iron Pressure Pipe and Fittings
3. A21.51 - Standard for Ductile Iron Pipe Centrifugally Cast
4. A21.53 - Standard for Ductile Iron Compact Fittings, 3-inch through 16-inch

B. ASTM:

1. A48 - Specification for Gray Iron Castings
2. A74 - Specification for Cast Iron Soil Pipe and Fittings
3. C76 - Specification for Reinforced Concrete Pipe
4. C361 - Specification for Reinforced Concrete Low Head Pressure Pipe
5. C425 - Specification for Compression Joints for VCP and Fittings
6. C478 - Specification for Precast Reinforced Concrete Manhole
7. C564 - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
8. D2321 - Recommended Practice for Installation of Flexible Thermo-plastic Sewer Pipe
9. D3034 - Specification for PVC Sewer Pipe and Fittings
10. F477 - Elastomeric Seals for Joining Plastic Pipe
11. F679 - Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
12. F714 - Specification for PE Sewer Pipe and Fittings

13. F1336 - Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings

1.03 SUBMITTALS

- A. Submit Shop Drawings for each manhole.
- B. Quality Assurance/Control Submittals:
 1. Submit Certificates of Compliance from manufacturers certifying that materials meet reference specifications listed in Article 1.02.
 2. Submit record of service connections weekly to Engineer.

1.04 HANDLING AND DELIVERY OF MATERIALS

- A. Inspect pipe and materials during unloading process and notify Engineer of cracked, flawed or otherwise defective material.

1.05 STAKING

- A. Engineer shall provide necessary staking for all work under this Section.

1.06 MAINTAINING SEWER SYSTEM

- A. Maintain flow in sanitary sewers on continuous basis while construction is underway.
- B. Plug sewers with inflatable plug. Provide pumps, portable generators, hoses, and related items appurtenant to the Work.
- C. Sewer service lines to individual users may be disconnected for a period not to exceed 3 hours.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Provide the following:

Material	Class	Joint
PVC	SDR 35 SDR 26 Schedule 40 ASTM D3034 ASTM F477	Elastomeric Gasket Water Stop Gasket
Cement Lined Ductile Iron	Class 52 ANSI A21.4 ANSI A21.11 ANSI A21.51 ANSI A21.53	Push-On (Pipe) Mechanical (Fittings)
HDPE	SDR 17	Butt-Fusion

B. Provide pipe and fittings of each material type from same manufacturer.

C. PVC Pipe Class:

1. SDR 35 – Bury depth 0-14 feet.
2. SDR 26 – Bury depth 14-24 feet.
3. DIP CL 52 – Bury depth > 24 feet.
4. Or class as specified on Contract Documents.

D. Service Pipe:

1. 4-inch PVC
 - a. SDR 35 – Bury depth 0-14 feet.
 - b. SDR 26 – Bury depth 14-24 feet.
 - c. Schedule 40 – Bury depth > 24 feet.
 - d. Or class as specified on Contract Documents.

E. Trace Wire:

1. Insulated #10 solid core trace wire rated for underground service applications.
 - a. Color - Green

F. Service Pipe Couplings:

1. Connect to Existing Service:
 - a. Fernco, Inc., Quikseal or approved equal.
 - b. Connector model number shall be selected based on manufacturer's recommendations for pipe size and depth of service.

G. PVC Pipe Fittings:

1. ASTM D3034, F679, F1336, F477, F913.
 - a. SDR 26 wall thickness

b. Lock-in gasket

H. Cut in Saddle Fittings:

1. Romac Industries, Inc., Style "CB" Saddle or approved equal.
2. GPK PVC Saddle or approved equal for connections to PVC or VCP 10" or less mains.
 - a. Stainless steel compression straps.

2.02 TRACE WIRE

A. Copperhead Industries, LLC or approved equal.

1. #10 AWG Solid Copper Core
 - a. Rated for underground applications.
 - b. Color – Green.
 - c. Minimum 45 mil HDPE, 30 volt minimum rating.
 - d. Attached to pipe in a manner that ensured it remains intact throughout the entire installation process.

2.03 INSULATION

- A. Rigid, extruded polystyrene board insulation.
- B. Thermal Resistance (R): 5.0.
- C. Thickness: 2-inch
- D. Board Size: 48-inch by 96-inch.
- E. Compressive Strength: Minimum 25 psi.
- F. Water Absorption in accordance with ANSI/ASTM D2842: 0.1 percent by volume, maximum.
- G. Edges: Square.

2.04 MANHOLES

A. Precast Sections:

1. ASTM C478.
2. Cone: Eccentric.
3. Pipe Joints: ASTM C443, Gasketed, water-tight.
4. Minimum 48" diameter.

B. Covers and Frames:

1. ASTM A48:
 - a. Neenah R-1733- Heavy Duty, or approved equal
 - 1) Self sealing
 - a) Continuous machined dovetail groove in lid seat with 1/4" diameter neoprene gasket

- (1) Oil and weather resistant
- (2) Minimum tensile strength of 100 psi
- (3) Allowable elongation of 500%
- (4) Durometer rating of 40
- 2) 2 concealed pick holes
- 3) Stamped "Sanitary Sewer"
 - a) 2" letters

C. Adjusting Rings:

1. Reinforced concrete
 - a. Minimum 1 and maximum 4 rings
 - b. Adhesive PL-500 or approved equal between ring

D. Concrete Collar

1. Curb and gutter mix or mortar mix (Spec. 2506.2B)
 - a. Encase casting and concrete adjusting rings
 - b. 6" minimum thickness

E. Pipe Connections:

1. Precast openings
 - a. Rubber boot
 - b. Water tight
2. Field constructed
 - a. Core drilled
 - b. Rubber boot
 - c. Water tight

F. Steps:

1. Manholes shall **not** have steps, unless otherwise specified.

G. Mortar

1. ASTM C270
 - a. Pre-blended Spec Mix
 - b. Underground utility mortar containing Portland cement and hydrated lime, masonry cement or mortar cement and dried masonry sand.

2.05 DROP STRUCTURES

A. Outside Drop Structure

1. Constructed as shown on City of Richfield standard details SAN-02 (Sanitary Drop Manhole).

B. Inside Drop Structure

1. No inside drop over 2-feet allowed without prior written approval from the City Engineer.
2. Contractor shall form a concrete flume invert to match into manhole bench and invert.

PART 3 EXECUTION

3.01 PREPARATION

- A. Contractor shall notify City Engineer at least 48 hours prior to commencing any work. Contractors are subject to being shut down and or having work rejected if proper notification is not given to the City.
- B. Work shall not commence before 7:00 a.m. nor extend beyond 10:00 p.m. Monday thru Friday. On Saturdays, work hours are from 8:00 a.m. to 6:00 p.m. No work is permitted on Sundays or Holidays unless authorized by the City of Richfield. The definition of "work" also includes the starting of equipment and the delivery of materials to the job site.
- C. Line and Grade: Provide means for accurately transferring line and grade from ground surface stakes to working point in trench.
- D. Water Stops: Provide in manholes as required to prevent infiltration into system.

3.02 CONSTRUCTION REQUIREMENTS

- A. Pipe Installation:
 1. Comply with ASTM D2321 for PVC installation.
 2. Inspect pipe for defects and cracks while suspended before lowering into trench.
 3. Remove all foreign matter or dirt from the inside of the pipe and fittings prior to lowering them into position in the trench.
 4. Place pipe bell at upstream end of pipe length.
 5. Install pipe from lower to higher invert elevation at a uniform slope between manholes.

6. Fit pipe spigot ends into bell end of receiving pipe and push to "home" position.
 7. Where specified, encase joints in concrete to form a rigid watertight unit as indicated in the standard drawings.
 8. Place plug in end of incomplete piping until next pipe is lowered into trench, at end of the day and when Work stops.
 9. Provide watertight plugs at future connection plugs.
 10. When water is present in trench, seals are to remain in-place while trench is pumped completely dry.
 11. See Section 31 23 33 for pipe foundation and backfill.
 12. Maximum Allowable Deviation From Staked Grade:
 - a. Alignment: 0.30 feet.
 - b. Elevation: 0.02 percent.
- B. Connect to Existing manhole
1. Core drill and install rubber boot on all field connections to existing manholes.
 2. Reconstruct manhole invert and bench to provide unrestricted flow thru manhole to low invert.
- C. Service Wye:
1. Install mainline PVC wye at service location.
 2. Install per Standard Drawings.
 3. Where wyes do not exist on existing PVC sewer mains, remove section of sewer main and replace with PVC wye and main section by means of an approved sleeve coupling.
 4. Cut in wyes shall be core drilled to produce a uniform, smooth circular cut-out as required for proper fit.
 5. Cut out discs shall be retrieved and shall not be allowed to remain within sanitary sewer pipe.
 6. Saddle tee shall be securely fastened to the main sewer pipe by means of epoxy resin or other approved adhesive.
 7. Encase connection in concrete to a minimum thickness of six inches and as show on the Standard Drawings.
- D. Manhole Installation:
1. Place precast manhole base on compacted granular subgrade.
 2. Provide monolithic base for drop manholes.
 3. Maximum Allowable Deviation From Staked Grade:
 - a. Alignment: 0.30 feet.
 - b. Elevation: 0.03 feet.
 4. Verify top of manhole cone elevation will result in a minimum 1 and maximum of 4 adjusting rings under casting.
 5. Install casting tops to ¼" below the finished grade.
 6. Set adjusting rings and casting in a full bed of mortar. All units shall be properly fitted and sealed to form a completely water tight structure. Plaster mortar on outside of structure to a smooth surface. Strike inside mortar clean and smooth.
- E. Service Pipe:
1. Install service pipe in conformance with all applicable requirements of the main sewer installation.
 2. Install service pipe at right angles to the main sewer and at a straight line to the point of connection or termination. Bends shall not exceed 22 ½ degrees and must be deemed necessary and approved by the engineer.
 3. Extend pipe to right-of-way or easement line, as shown on the plans, or as directed by Engineer.
 4. Install pipe at minimum 2 percent or as approved by Engineer.
 5. Place water tight PVC solvent cap at end of pipe, cast iron stopper, or other cap as approved by engineer.
 6. Place service lines as deep as required to serve the property. Service Riser Sections shall be installed in accordance to the details shown on the standard drawings.
 7. Mark end of service with a 4-inch by 4-inch by 8-foot timber set 4 feet below grade.
 8. Maintain a record of each service connection as follows to be submitted to Engineer at the end of each week:
 - a. Type of service connection.
 - b. Distance from downstream manhole.
 - c. Length and elevation of service line.

- d. Ties to service connection or termination of service pipe.
- e. Length of riser.
- f. Service records shall be maintained jointly by the Contractor and Engineer on forms provided by the Engineer.
- g. Service installations shall not be backfilled until all required information has been obtained and recorded.

F. Riser Pipe:

- 1. Extend riser from service connection at 45-degree angle above horizontal to a point 11 feet below street grade.
- 2. Install riser pipe against undisturbed trench wall.
- 3. Place concrete collar around service connection as shown on Drawings.

3.03 FIELD QUALITY CONTROL

A. Remove all dirt and foreign material from pipe interior prior to testing.

B. Gravity Sewer Pipe:

- 1. Pipe Diameter 27 Inches and Smaller:
Air test.
- 2. Pipe Diameter Larger Than 27 Inches:
Infiltration test.

C. Perform the following tests upon completion of sewer construction and prior to any external plumbing connections:

- 1. Infiltration Test:
 - a. Manholes shall be watertight, with no leakage permitted.
 - b. Place 90-degree V-notch weirs in locations directed by Engineer to measure leakage in sewer lines.
 - c. Allowable leakage rate shall be 100 gallons/day/inch diameter/mile of sewer between any adjacent manholes.
 - d. Provide corrective measures for lines exceeding the allowable leakage rate.
- 2. Air Test:
 - a. Place inflatable sewer stoppers in manhole at each end of reach to be tested.
 - b. Connect 1 end of an air hose to plug used for air inlet.

- c. Connect other end of hose to portable air control equipment.
- d. This equipment consists of valves and pressure gages used to control the rate air flows to the test section and to monitor air pressure inside the pipe.
- e. Connect an air hose between compressor (or other source of compressed air) and control equipment.
- f. Add air to pipe section. Monitor air pressure so pressure inside pipe does not exceed 5.0 psig.
- g. When pressure reaches 4.0 psig, stop air supply so internal pressure is maintained for 2 minutes.
- h. These 2 minutes allow time for air temperature to come to equilibrium with the pipe walls.
- i. During this time check plugs with soap solution to detect any plug leakage. If plugs are found to leak, bleed off air, tighten plugs, and begin again by supplying air.
- j. After temperature has been allowed to stabilize for 2 minutes, disconnect air supply and allow pressure to decrease to 3.5 psig.
- k. At 3.5 psig, start stopwatch to determine time required for pressure to drop to 2.5 psig.
- l. Provide corrective measures for any line not meeting requirements.
- m. Test results are usually better if sewer pipe walls are damp at time of testing.
- n. Time shall be equal to or greater than the allowable time shown in table at end of this Section.
- 3. Deflection Test:
 - a. Perform on PVC pipe at least 30 days after trench backfill has been placed.
 - b. Perform test by pulling a mandrel through each line between manholes without aid of mechanical pulling devices.
 - c. Mandrel diameter: Minimum 95 percent of the base inside diameter of the pipe as follows:

Nominal Size (in.)	Base I.D.	5% Deflection Mandrel
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Nominal Size (in.)	Base I.D.	5% Deflection Mandrel
4	3.874	3.68
6	5.742	5.46
8	7.665	7.28
10	9.563	9.08
12	11.360	10.79
15	13.897	13.20
18	16.975	16.13
21	20.004	19.01
24	22.481	21.36
27	25.326	24.06
30	28.639	27.21
33	32.224	30.61
36	35.808	34.02
42	40.401	38.38
48	46.094	43.79

- d. The line will be considered acceptable if mandrel can progress through line without binding.
- e. Provide corrective measures for lines not meeting these requirements.

Time Required for a 0.5 PSIG Pressure Drop for Size and Length of Pipe Indicated

1 Pipe Diameter (inches)	2 Minimum Time (minutes:seconds)	3 Length for Minimum Time (feet)	4 Time for Longer Length (seconds)	Specified Minimum for Length (L) Shown (minutes:seconds)							
				100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:74	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:67	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09

- A. Test Failure and Remedy
 - 1. In the event of a test failure on any test section, testing shall be continued until all leakage has been detected and corrected to meet the requirements.
 - 2. All repair work shall be subject to approval of the Engineer.
 - 3. Introduction of sealant substances by means of the test water will not be permitted.
 - 4. Unsatisfactory repairs or test results may result in an order to remove and replace pipe as the Engineer considers necessary for test conformance.
 - 5. All repair and replacement work shall be at the Contractor's expense.
- B. Inspection and Flushing
 - 1. Prior to final acceptance of each section of the sewer line, the Contractor shall flush an approved pipe cleaning ball, the full diameter of the sewer, through all sewer up to 24" in diameter. Larger sewers shall be cleaned by other appropriate methods.
 - 2. All dirt and debris shall be prevented from entering the existing sewer system by means of watertight plugs or other suitable methods.
 - 3. All water and debris shall be removed from system by vacuum or other approved method.
 - 4. Upon completion of the Contract, the Engineer shall carefully inspect all sewers and appurtenances. Any unsatisfactory work shall be removed and replaced in a proper manner.
 - 5. The invert of the sewer shall be left smooth, clean and free from any obstructions throughout the entire line.
- C. Televising of Lines
 - 1. All sanitary sewer lines shall be televised and the video reports submitted to the City for review.
 - 2. Video reports can be submitted on CD-ROM or DVD compact disks.
 - 3. All lines must be flushed and cleaned prior to televising.
 - 4. The video report will be used to view the condition of the sanitary sewer pipe prior to acceptance.
 - 5. Workmanship and cleanliness of the installation will be checked.
- 6. Video reports will become property of the City and contain the following:
 - a. Reference to the start and end of each video segment as it begins, by clearly identifying the manhole number where the video segment begins and the manhole number where the video segment ends.
 - b. Footages along the sewer line must be shown on the video and report and zeroed out at the beginning of each segment starting from the center of the manhole.
 - c. The video camera should be guided forward at the moderate to slow pace along the bottom of the pipe.
 - d. The camera should stop and rotate up to view each service wye.
 - e. The camera should stop at any unusual instances that are viewed while in progress and provide a more detailed and longer view of the specific instance (i.e. – bad joint, dirt in lines, settlement in line, etc.)

END OF SECTION

SECTION 33 41 00

STORM SEWER SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Storm sewer pipe.
 - 2. Manholes and appurtenances.
 - 3. Catch basins and appurtenances.
 - 4. Aprons.
- B. Related Sections:
 - 1. Section 31 23 33 - Trench Excavation and Backfill
 - 2. Section 33 05 50 - Surface Facility Restoration
- C. Method of Measurement:
 - 1. Pipe:
 - a. Measure by distance in linear feet.
 - b. Measure from structure centers and pipe ends not including end sections.
 - c. Measure each pipe size and class separately.
 - d. Measurement includes pipe bedding per Standard Drawings unless otherwise stated in Contract Documents.
 - 2. Manholes:
 - a. Measure by height in linear feet to the nearest 0.1 foot.
 - b. Measure from the lowest invert to the top of the casting.
 - c. Measure each size and type separately.
 - 3. Catch Basins:
 - a. Measure by height in linear feet to the nearest 0.1 foot.
 - b. Measure from the lowest invert to the top of the casting.
 - c. Measure each size and type separately.
 - 4. Castings: Measure each type installed as a unit.
 - 5. Aprons: Measure each size and type installed as a unit.
 - 6. Riprap: Measure by volume in cubic yards of material in place.

- 7. Connect to Existing Storm Sewer: Measure each connection as a unit.
- 8. Dewatering: Incidental and no measurement will be made for dewatering unless otherwise specified in Contract Documents and included as a pay item.

- D. Basis of Payment:
 - 1. Payment for acceptable quantities of storm sewer items shall be at the Contract Unit Price as listed on the Bid Form. All associated Work items shall be considered incidental.

1.02 REFERENCES

- A. ASTM:
 - 1. A48 - Specification for Gray Iron Castings
 - 2. C76 - Specification for Reinforced Concrete Pipe
 - 3. C361 - Specification for Reinforced Concrete Low Head Pressure Pipe
 - 4. C443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
 - 5. C478 - Specification for Precast Reinforced Concrete Manhole
 - 6. D2321 - Recommended Practice for Installation of Flexible Thermo-Plastic Sewer Pipe
 - 7. F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 8. F667 - Standard Specifications for Large Diameter Corrugated Polyethylene Pipe and Fittings

1.03 SUBMITTALS

- A. Submit Certification of Compliance from manufacturer certifying materials meet the respective requirements listed in Article 1.02.
- B. Provide Shop Drawings for each structure.

1.04 DELIVERY OF MATERIALS

- A. Inspect all pipe and materials during the unloading process.
- B. Notify Engineer of any cracked, flawed or otherwise defective material.
- C. Remove all materials found to be unsatisfactory by Engineer from the Site.

PART 2 PRODUCTS

2.01 PIPE

- A. Reinforced Concrete:
 - 1. MnDOT Specification 3236
 - 2. Class: See Drawings.
 - 3. Formed rubber gasket per ASTM C443.
- B. ADS or Approved Equal
- C. Provide all pipe from the same manufacturer.
- D. **No** PVC or corrugated metal pipe (CMP) shall be used for mainline storm sewer within the public Right-of-Way unless previously approved by the City Engineer.

2.02 MANHOLES AND CATCH BASINS

- A. ASTM C478 & MnDOT 2506.
- B. See Drawings for diameter.
- C. Provide gasket joint per ASTM C443.
- D. Provide base, cone section or cover slab as shown on Drawing details.
- E. Manhole Steps:
Manholes shall **not** have steps unless otherwise specified.
- F. Covers and Frames:
 - 1. ASTM A48:
 - a. Neenah R-1733-Heavy Duty – Storm Sewer Manholes
 - b. Neenah: R-3067V – Catch Basins
 - 2. Storm sewer manhole covers shall have “Storm Sewer” displayed in 2” letters.
 - 3. Cover with 2 concealed pick holes.

- 4. Casting assemblies or dimensions, details, weights, and class shall be as indicated in the detailed drawings for the design designation specified. Unless otherwise specified, the casting shall be Class 30 or better.
- 5. Lid-to-frame surfaces on round casting assemblies shall be machine milled to provide true bearing around the entire circumference.
- 6. Casting weight shall be not less than 95 percent of theoretical weight for a unit cast to exact dimensions, based on 442 pounds per cubic foot.

G. Adjusting Rings:

- 1. Reinforced Concrete
- 2. Minimum of 1 and maximum of 4 adjusting rings.

H. Concrete Collar

- 1. Curb and gutter mix or mortar mix (Spec. 2506.2B)
 - a. Encase casting and concrete adjusting rings
 - b. 6” minimum thickness

I. Mortar:

- 1. ASTM C270
- 2. Air-entrained of one part masonry cement, Type M, and two parts mortar sand, with sufficient water to produce proper consistency, and with sufficient air-entraining agent added to maintain an air content within the range of 10 percent.

2.03 APRONS

- A. Provide the same strength class as the pipe.
- B. Provide galvanized trash guards on aprons as specified on the Plans or as directed by Engineer.

2.04 RIPRAP

- A. In accordance with MnDOT 2511
- B. Class III unless otherwise specified.
- C. Individual stones not less than 50 lbs each
- D. Filter Materials for riprap:
 - 1. MnDOT 3601 – Granular Filter

2. MnDOT 3733 – Type II Geotextile Fabric

outlined in the MnDOT Road Design Sections 8-6.01.08 and 8-6.01.09.

PART 3 EXECUTION

3.01 PREPARATION

- A. Contractor shall notify City Engineer at least 48 hours prior to commencing any work. Contractors are subject to being shut down and or having work rejected if proper notification is not given to the City.
- B. Work shall not commence before 7:00 a.m. nor extend beyond 10:00 p.m. Monday thru Friday. On Saturdays, work hours are from 8:00 a.m. to 6:00 p.m. No work is permitted on Sundays or Holidays unless authorized by the City of Richfield. The definition of “work” also includes the starting of equipment and the delivery of materials to the job site.
- C. Line and Grade:
 - 1. Conform to lines, elevations, and grades shown on the Drawings.
 - 2. Provide means for accurately transferring line and grade from ground surface stakes to the working point in the trench.

3.02 CONSTRUCTION REQUIREMENTS

- A. Pipe Installation:
 - 1. Inspect pipe for defects and cracks while suspended before lowering into the trench.
 - 2. Remove, clean, or trim any foreign matter, coating blisters, rough edges or projections and any imperfections so detected on pipe section and fitting.
 - 3. Comply with ASTM D2321 for HDPE installation.
 - a. See Drawings for bedding details.
 - 4. Place pipe bell at upstream end of pipe length.
 - 5. Install pipe from lower to higher invert elevation.
 - 6. See Section 31 23 33 for pipe foundation and backfill procedures.
 - 7. Storm sewer pipes which cross the street in areas where soils are highly frost susceptible, shall be backfilled in accordance with the guidelines as are

- B. Manhole and Catch Basin Installation:
 - 1. Place precast base on compacted granular subgrade.
 - 2. Granular material shall be placed under all storm sewer pipe or structures that are less than 48-inches below finished grade. Granular material shall extend to at least 48” below finished grade and taper up to the subgrade elevation at not steeper than a 10 percent slope.
 - 3. Install in accordance with drawing details.
 - 4. No steps allowed.
 - 5. Install concrete adjusting rings to provide final horizontal and vertical adjustment within tolerances. Set adjusting rings and casting in a full bed of mortar. All units shall be properly fitted and sealed to form a completely water tight structure. Plaster mortar on outside of structure to a smooth surface. Strike mortar on inside of structure clean and smooth. No shims or blocking will be allowed.
 - 6. Minimum of 1 and maximum of 4 adjusting rings shall be used.
 - 7. Maximum horizontal tolerance: 3 inches in any direction.
 - 8. Construct watertight to prevent groundwater infiltration.
 - 9. Install sediment trapping device in catch basin inlets as directed by Engineer to prevent sediment from entering storm sewer systems during construction. Inlet protection shall be in accordance with MnDOT 3891.
- C. Apron Installation:
 - 1. Tie aprons to next six pipe sections using galvanized “U” bolt fasteners.
 - 2. Tie all pipes in and out of skimmer structures.
 - 3. All applicable requirements for pipe installation apply to apron installation.
- D. Riprap Installation:
 - 1. Prepare ground area at apron end per Standard Details.
 - 2. Install filter materials as specified in Standard Drawings.

3. Riprap required for various pipe sizes shall be shown on the Standard Drawings, unless otherwise specified.
4. Hand place riprap to a depth of one foot.

E. Connect to Existing Storm Sewer:

1. Connect to Existing Storm Manhole or Catch Basin:
 - a. Remove bulkhead or cut existing manhole to provide adequate opening for pipe.
 - b. Take necessary precaution to prevent dirt or debris from entering the existing structure.
 - c. Install pipe at staked alignment and grade
 - d. Install mortar around pipe to provide a minimum 6" watertight collar on outside of structure.
 - e. Strike mortar smooth on inside of structure to provide watertight seal.
2. Connect to Existing Storm Pipe
 - a. Remove existing bulkhead or pipe at connection point.
 - b. Take necessary precaution to prevent dirt or debris from entering the existing structure.
 - c. Clean existing pipe bell
 - d. Insert pipe spigot end into existing pipe bell end and push into home position.

3.03 FIELD QUALITY CONTROL

A. Deflection Test:

1. Perform on HDPE pipe at least 30 days after trench backfill has been placed.
2. Perform test by pulling a mandrel through each line between manholes without aid of mechanical pulling devices.
3. Mandrel Diameter: 95 percent of nominal pipe size.
4. The line will be considered acceptable if mandrel can progress through line without binding.
5. Provide corrective measures for lines not meeting these requirements.

B. Test Failure and Remedy

1. In the event of a test failure on any test section, Contractor shall provide corrective measures for lines not meeting requirements.

2. All repair work shall be subject to approval of the Engineer.
3. Unsatisfactory repairs or test results may result in an order to remove and replace pipe as the Engineer considers necessary for test conformance.
4. All repair and replacement work shall be at the Contractor's expense.

3.04 CLEANING

A. Remove all dirt and foreign material from the pipe and structure interiors.

B. Inspection and Flushing

1. Prior to final acceptance of each section of the storm sewer, the Contractor shall flush an approved pipe cleaning ball, the full diameter of the sewer, through all sewer up to 24" in diameter. Larger sewers shall be cleaned by other appropriate methods.
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2. Video reports can be submitted on CD-ROM or DVD.
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4. The video report will be used to view the condition of the sanitary sewer pipe prior to acceptance.
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- a. Reference to the start and end of each video segment as it begins, by clearly identifying the manhole number where the video segment begins and the manhole number where the video segment ends.
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- c. The video camera should be guided forward at the moderate to slow pace along the bottom of the pipe.
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- e. The camera should stop at any unusual instances that are viewed while in progress and provide a more detailed and longer view of the specific instance (i.e. – bad joint, dirt in lines, settlement in line, etc.)

END OF SECTION